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Natalia Shakhova

Research advisor:

Associate Professor

Dmitry V. Kudryavtsev

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ЗАЯВЛЕНИЕ О САМОСТОЯТЕЛЬНОМ ХАРАКТЕРЕ ВЫПОЛНЕНИЯ ВЫПУСКНОЙ КВАЛИФИКАЦИОННОЙ РАБОТЫ

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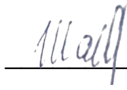

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ABSTRACT

Author:	Natalia Shakhova
Title of thesis:	Knowledge Management System for a business incubator
Faculty	Graduate School of Management
Main Field of Study	Management
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Academic Advisor's Name	Dmitry Kudryavtsev
Description of the goal, tasks and main results	Knowledge management, as a strategic asset, enhances start-ups performance in business incubation environment through facilitating knowledge transfer and creation. The goal of the current study is to explore the role that knowledge management system, taking a combination of practices and tools, plays for business incubators. To achieve results, we conducted a survey to analyze an extent to which knowledge management systems being used, and interviews to explore business incubators' perception and an application of knowledge management practices and tools. The relevance of the topic and achieved results are confirmed by complicating the competition within industry and need for increasing successfulness of start-up firms as entrepreneurial activity appears to be recovered from the crisis, according to OCED analysis for the 2017 year.
Keywords	Knowledge management system, knowledge management practices, business incubator, knowledge management tools

АННОТАЦИЯ

Автор:	Наталья Александровна Шахова
Название магистерской диссертации:	Система управления знаниями для бизнес инкубатора
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Описание цели, задач и основных результатов	Практика управления знаниями, как стратегический актив, повышает эффективность стартапов в условиях бизнес-инкубатора за счет содействия процессам передачи и создания знаний. Цель настоящей работы заключается в изучении роли, которую система управления знаниями, взятая как сочетание практик и инструментов, играет для бизнес-инкубаторов. Для достижения результатов был проведен опрос, анализирующий степень использования систем управления знаниями, и интервью, призванные изучить понимание, восприятие и оперирование практиками и инструментами управления знаниями со стороны инкубационного сообщества. Актуальность темы и достигнутых результатов подтверждается усложнением конкуренции в рамках индустрии и необходимостью повышения успешности стартапов, поскольку предпринимательская активность, по-видимому, восстанавливается после кризиса, - согласно аналитике ОЭСР за 2017 год.
Keywords	Управление знаниями, менеджмент знаний, система управления знаниями, система менеджмента знаний, бизнес-инкубатор

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Introduction

For the last decades, knowledge is considered to be a strategic resource that an organization may use to achieve competitive advantage (Bollinger & Smith, 2001): on the foundation of the resource-based theory of firm was developed knowledge-based, which later had only been strengthened in the academic field. Knowledge potentiality to form a competitive edge has been studied in a range of different industries such as consulting (Sarvary, 1999), services (Soniewicki, 2017), oil and gas (Grant, 2013), and airline (Tckhakaia, Cabras, & Rodrigues, 2015). Most of the mentioned studies are dedicated to large companies and imply that SMEs tend to manage knowledge without any specific framework since the nature of channels of knowledge acquiring, communication and transfer is rather transparent than complex.

An absence of formal knowledge management structures, which is pretty intrinsic for SMEs, is referred as "informal knowledge management" (Hutchinson & Quintas, 2008). Informal systems could not become a sustainable competitive advantage for an organization, although a firm, particularly SME, could benefit from the easily coordinated knowledge flows[1]. Thus, due to the potentiality to gain competitiveness, it is assumed that for newly appeared unscaled organizations, structures and speed of flows seemed to be no less valuable than the knowledge by itself, possessed or not by its associates.

This premise has been justified by the range of studies demonstrating the importance of knowledge resources and arguing that the latest is responsible for rapid growth and a competitive advantage that the firm could gain (Zhao, Zhang & Wu, 2017). Small business indeed tends to have informal inner structures and procedures, resulting in being flexible, and to experience lack of resources and expertise. Entrepreneurs face not only problems of the lack of coordination or blurred boundaries of responsibilities, but also problems connected to lack of business experience and business knowledge (Patton & Marlow, 2011, and Kvedaraite, 2014).

Today specific spaces are designed for the purpose of supporting newly appeared companies and owners: business and university incubators, accelerators, technoparks (technology

[1] The notion of informal knowledge management was introduced to differentiate processes typical for companies based on the size of the latest. However, it is necessary to emphasize that the main focus of the text is a practical one and treating knowledge in an informal way is challenging for the complex companies because knowledge is required to be captured, acquired, communicated, shared and transferred, and applied on all the levels.

parks), technopolises and associations. In general, such organizations assist start-ups and companies on different stages of development, pursuing all or some of the following goals: to elaborate regional economy, to ensure company's success and to earn benefits.

For SMEs and companies that only started their existence or going to, it seems reasonable to use such services if they indeed can assist with solving issues crucial for developing companies: gaining expertise, experience, network, liability, financial support, synergy effect of cooperating with partners and parent organization as well as simple cost savings (Blok, Thijssen, & Pascucci, 2017).

Particularly, for many start-ups, a need to use counseling and supporting services is caused by the already mentioned lack of business knowledge and experience among the employees and founders (Patton & Marlow, 2011). To overcome difficulties connected to the absence of the business education and history and to be able to define the potential and opportunities of the business idea or firm, entrepreneurs resort to programs offered by incubators.

Business incubators, in return, dispose own processes of selecting companies to work with, whether it should be done directly or in affiliate way (Lewis, Harper-Anderson, & Molnar, 2011), defining a strategy of orientation, assessment and limitations of accompaniment (Ramkissoon-Babwah & David, 2014, and Anholon, Novaski, Pinto, & Porto, 2016).

Expertise offered by an incubator and its assistance services not only supports alternating an actual experience but also could provide a tenant company tacit knowledge that is already possessed by competitors in the industry (Miller & Besser, 2005) by means of the learning programs, mentors, network and synergy effects.

Studies conducted on the needs of business owners show that assistance on the business knowledge and expertise are ones of the most frequently used and demanded services (Robinson & Stubberud, 2014). According to them, popular areas are a business strategy, marketing, finance and quality assurance (in decreasing order). A table given below illustrates the distribution of topics that entrepreneurs are likely to have a need in covering:

Table 1. Adopted from Anholon, Novaski, Pinto, & Porto, 2016.

Strategy		Marketing	
Competitive advantage	25%	Marketing concepts, tools and sales management	33%

Core business	24%	Product marketing	30%
Goals and objectives definition	19%	Event marketing	19%
Market and competitors analysis	19%	Product life-cycle and development	19%
Performance indacators	17%	Customer analysis	17%
Finance		Quality assurance	
Taxes legislation	33%	Certification and standards	22%
Costs and working capital	19%	Quality performance indicators	18%
Cash flow	18%	Company organization	18%
ROI	16%	Quality tools	17%
Contributed margin	15%	Problems solving methodology	16%

Assisting organizations offer education and training activities and programs to cover the demand. Generally, such programs include mentoring and hard and soft skills development, whether conducted systematically or on demand. We propose to focus deeply on the business incubators peculiarities and knowledge management characteristic for them to investigate the development of the research field with respect to those. The focal point of our research is a knowledge management system as a complex of practices and tools that could bring benefits for the knowledge-intense incubation industry.

Chapter 1. Knowledge Management and Business Incubators

1.1 Business incubation industry overview

A phenomenon of business incubation, which usually refers to a specific space and environment aimed to provide start-ups and SMEs with support for development (Bergek & Norrman, 2008), counted its history from 1959 from appearing of Batavia Industrial Center in New York. Some researchers tracing the roots to 1951, year of foundation of the Scientific Technologic Park (STP) "Stanford Research Park" (Tola & Contini, 2015). Expanding of the concept started later in 1985, when National Business Incubation Association, previously NBIA – for now it's International Business Innovation association, InBIA (InBIA, n.d.), was founded with 40 members.

Most of papers agrees that the development of the business incubation industry has passed three following stages (Lalkaka, 2015):

- 1959 – 1980s

The first period is characterized by offered spaces and shared administrative services without training and coaching programs. Nowadays presented in the co-working space format. Such spaces mainly were used to cut expenditures on the commodities and utilities through an access to shared resources: equipment, office rooms and facilities.

- 1980s – 1990s

The second stage stands out with first educational activities that were offered. Incubators started to focus on industries and sectors (technology, arts) by means of government support which gave the first impulse after recognized that entrepreneurial potential boost economy.

Simultaneously, first, very basic, virtual incubators appeared.

- 2000s – nowadays

The current, third, period is represented by the wide use of a network model with a focus on external contacts and sources that the last could provide an access to (both in terms of knowledge, expertise, and funding). Characteristically also the popularization of private incubators.

As for the classification of those spaces, InBIA differentiates business development centers, technology parks, and business incubators. The business development center is a government based structure that works on the demand of company with business without respect to scale or stage. Technology parks specialize in already established companies but business services are not the main focus of them. Business incubator focuses on early-stage firm or virulent start-up with a focus on supporting services.

The accurate amount of business incubators worldwide is unknown due to challenges in defining what "business incubator" exactly is and different approaches to registering and classifying such organizations in different countries. An estimated amount calculated as a median from information gathered from infoDev (A World Bank Group Program to Promote Entrepreneurship & Innovation) and Global Accelerator Report 2016 (Global Accelerator Report 2016) is more than 10,000 incubators worldwide. The reliability of this amount confirmed by the fact that mean rate of incubators that agree to participate in different studies is 30% and UNI Global Ranking got 1370 companies from 53 countries engaged into its survey.

The following table presents data on the number of incubators in countries that was confirmed by government representatives:

Table 2. Estimated statistics by countries

Country	Approximate number of business incubators
USA	1500
UK	50
Russia	140
China	3200
Canada	150
India	140
Europe	300
Israel	130
Japan	203

It is undoubtedly that China is the country with the greatest number of business incubators: the country's five years plan from 2016 to 2020 was targeted to reach 10,000 of incubators and accelerators in the country. The 2025 plan that focuses on the high-tech development and

curtailment of cheap production so the incubation industry should support China's strategy. Researchers highlight that developing countries promote the business incubation industry model attempting to create an entrepreneurial environment, while developed countries focus on the switching towards the innovation economies, however in both cases keeping as the goal boosting wealth and job creation.

Previously mentioned difficulty connected with different approaches to the notion of business incubator within reports and statistical data resulted in the roughly approximate estimation of business incubators' number, also meets in the research field. For example, some researchers question the difference in notion and tend to consider accelerators, research or science parks, innovation centers and technopolices to be the synonyms for the business incubator (Bøllingtoft and Ulhøi, 2005), while others struggling to distinguish among them. Below is given a comparison table summarizing main criteria for differentiation used by the scholars.

Table 3. Criteria for classification in the research field

Authors	*Criteria*	*Classification and examples*
Wilber and Dixon	Profit orientation	For-profit
		Non-Profit
	Program Orientation	Technology
		Empowerment
		Mixed
		For-profit
EU Commission	Profit orientation	Non-Profit
		For-profit
Becker and Gassmann	Profit orientation	Non-Profit
		Government
	Funding base	Independent
		Corporate
		For-profit
Grimaldi and Grandi (2005)	Objectives and scope	Corporate incubator
		Private independent incubator
		Center if innovation
		University incubator

Dempwolf, Auer and D'Ippolito	Program structure and organization	Accelerator-like organization
		Incubator-like organization
	Main objectives of program	Profit generation: Innovation Accelerator Corporate Accelerator Venture Development
		Research support: Innovation Accelerator University Accelerator Incubator
Lalkaka	Market and location	International Local Virtual
	Sectoral focus	Technology Arts Mixed
	Sponsoring actor	State Economic Development Group University Business Venture Capital

There were also implemented attempts for classification based on human resource management practices implemented by a company(Bakkali, Messeghem , & Sammut, 2014), but the suitability of this criteria is questionable. However, we can conclude that main defining factors are objectives, goal and duration of the program (if any exists). Reality is that today is difficult to imagine an incubator of even science park that are not offering any training or educational activities. Criteria such as business model construct (virtual, traditional, network incubators), space location and sectoral focus in the current paper are considered as a secondary because they do not influence the definition of the business incubator (Bollingtoft & Ulhøi , 2005). However, according to Bøllingtoft and Ulhøi (2005), incubators should focus on developing businesses

networks to support start-ups in their activities. In this way, incubators take intermediary role between the incubated firms and the external environment.

In terms of time limitations, business incubators seem to be most flexible, because they work on the rent basis, while accelerator prefers equity-based involvement in the business of the tenant (Dempwolf, Auer, & D'Ippolito, 2014). What unites them is the focus on mentoring programs and business assistance. Science or technology parks, in general, have a bigger scale scope, but also offer incubation or acceleration service, however, usually they appear across universities. Technopolis is an even more complex phenomenon that normally supported by a state or big corporations.

The current research uses a business incubation notion as a central concept for parent innovation-based organization that provides help for start-up and developing companies. Analysis of services provided by them shows that main activities common for incubators, accelerators and science parks are connected to knowledge procedures, thus, it is important to develop a clear understanding of the methodology underlying the success of residents and the parent organization.

Not considering the peculiarities of different incubators caused by the scope of the organization, it is important to highlight the most common characteristics of the most successful incubators (Bollingtoft & Ulhøi , 2005) which are:

- Entrepreneur environment and culture
- Access to mentorship
- Developed network of partners

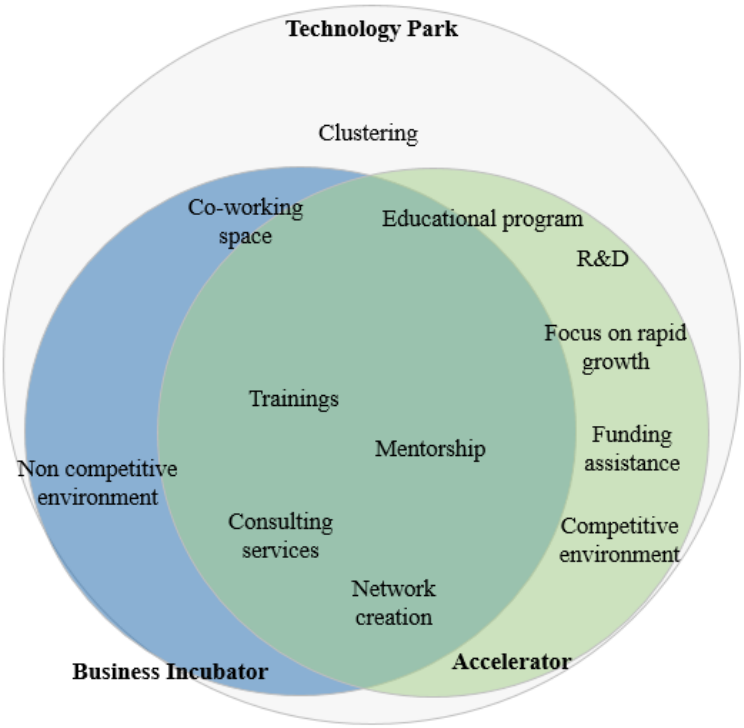

Figure 1. Services offered by organizations. Adopted from Dempwolf 2014.

Additional differentiation option is based on the Moore-Bygrave model of an entrepreneurial process (Bygrave, 2004): it provides an analysis of factors that are crucial for starting an enterprise in accordance with idea development stages: innovation, triggering event, implementation, and growth. Environment influence on all of the stages, starting with opportunities to innovate, giving a role model, competitors on the second and thirds stages and all business partners during the last, growth stage. We put the model under the light because it inscribes incubator in the environment field within triggering even and implementation stages, where the idea development firstly becomes to be dependent on the sociological factors. The position of the business incubator is to support an idea development and its implementation. We also pay attention to the factor that growth stage, when project disposes of its own organizational factors, previously absent or substituted by an incubator's forces, heavily relies on the all environmental and social experience gathered during the previous stages.

Running ahead, a substantial part of the literature related to the business incubation, or the studies that put the industry into their focus of attention, consider innovation capability as the most significant that residents gain by participation in incubation programs. Argumentation again this position is constructed upon the concept distinguishing and Moore-Bygrave model: nor the scope of incubation activities, not the stage of the projects supposes increase of innovativeness. If any

improvements in innovation area could be reached, this is nothing more than a side effect of the environment (spillovers that are covered later in the paper) and a result of entrepreneurial cheer he or she gets the support and first success. However, acceleration programs, unlike incubations, indeed could have such a goal.

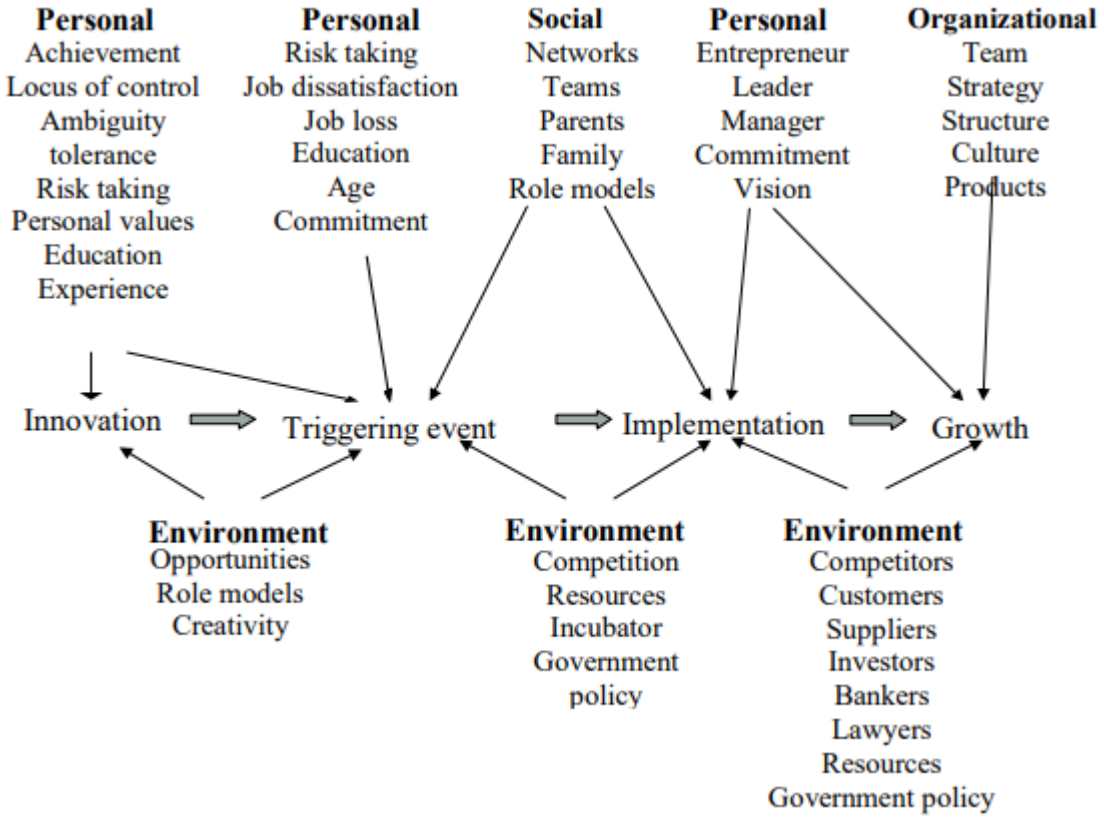

Figure 2. Services offered by organizations. Adopted from Bygrave, 2004

1.2 Knowledge Management

1.2.1 On the concept of knowledge

Earliest academic definitions of knowledge management describe it as "the process of capturing, distributing, and effectively using knowledge" (Davenport T. H., 1994). Later the same academic in co-authorship brings up the problem of distinguishing between data, information, knowledge, and wisdom (DIKW model) within the field, connecting it to knowledge management systems: "knowledge management draws from existing resources that your organization may already have in place-good information systems management, organizational change management, and human resources management practices" (Davenport & Prusak, 1998). It was noticed that most fixings within the field were built across the processes capturing (Castaneda, Manrique, & Cuellar, 2018), and the main approaches are the following:

Table 4. Comparison of concepts on the composition of knowledge process. Source: author's own

Author	Processes
Nonaka and Takeuchi 1995	creation, access, dissemination and application of knowledge
Wiig 1997	creation, maintenance, renewal, organization, transference and realization of knowledge
Liebowitz 1999	identification, capture, storage, sharing, application and selling of knowledge
Lin 2014	generation, access, facilitation, integration, embedding, application, transfer and protection of knowledge
Castaneda 2015	creation, acquisition, documentation, storage, electronic transference, face-to-face sharing and use and reuse of knowledge

As for more contemporary works, knowledge management being defined as a set of activities the company executes to maintain or develop an advantage, which could be transferred to strategic one if knowledge asset was correctly implemented and inscribed into the company structure (Girard, 2015). Due to the wide utility of the definition this paper referrers and understands knowledge management entirely within the scope of this interpretation.

On the concept of knowledge as it approached within the management discourse, authority of some experts in knowledge management gained allows to refers to pretty outdated, but still actual researchers, which eliminates a need to invent a bicycle. In addition, a major part of academical articles would refer to the same well-established approach of classification and typologization of knowledge. However, there is some variability on the exact definition of knowledge, thus we find it suitable to introduce the interpretation on the basis of distinguishing what is cannot be named knowledge. As a foundation, we use already mentioned DIKW hierarchy model by Ackoff as it became undoubtedly popular even in spite of criticism (Bernstein, 2009),

where data refers to symbolic yet unstructured layer, information represents the next layer of processed data, knowledge represented comprehend information and wisdom – embedded knowledge overpast through process of understanding.

In the business area, the very basic distinction on the form of knowledge is based on the extent of the ease with each the knowledge could be retrieved: tacit and explicit. The concept of tacit knowledge is widely explained through the association with 'hiden': this kind of knowledge does not necessarily represent any substance with respect to form and, the agent, carrier of the knowledge can even be not aware of that. Very simple illustration of the tacit knowledge portrayed into any Plato's dialogue – Socrates questions his interlocutor about particular notion making him discover an absence of the knowledge and turning this into actual knowledge. Even contemporary epistemology keen to analyze and discover methodological foundations that allow unhiding the knowledge.

Reference to philosophy is caused by few reasons: first, to emphasize the level of interest the humanity has from the postmythical period up to date towards the tacit knowledge, and, second, to highlight the role of an external agent in the process of capturing. Despite the fact that there are practices of subjectivity that do not require any mentor, most of them would agree on the necessity and utility of guiding. Even from the business perspective, tacit knowledge is recognized as the most valuable source of innovations, from which competitive advantage could be created, leading to breakthroughs for the company (Wellman, 2009), if managed to capture this knowledge.

The second type of knowledge, explicit, characterized by having an expressive form. Most current concerns about explicit knowledge are caused by the volume it could take and the necessity to handle and structure this knowledge, to keep an access to it for whenever needed it could be retrieved and furtherly used.

Essential to mention that distinction between these kinds of knowledge is not srtict and commonly accepted within the research field. Some academics tend to separate them as mutually exlusive, some prefer to kept them away from separation holding however complementary character of their interconnection. For now and in the scope of present paper it is not relevant to adhere to any camp, but it is principal to designate that (1) there are mutual relationship between explicit and tacit knowledge and (2) the one supports the other through ongoing trasfer and transformation of knowledge. Those statements were indroduced by Nonaka and are commonly accepted, playing roles of main building blocks in the discipline.

One more typology of knowledge that could be traced historically is based on the ground of the object and channel of knowledge: know-what, know-how, know-why and know-who (Lundvall, 2016). Consistently, they refer to knowledge of facts, skills, structure, and subjects. What and why knowledge is recognized as explicit-related: those types of knowledge could be codified and after easily obtained, while how and who knowledge are practically acquired and rather tacit.

Regrettably, the state of knowledge management theory does not allow to avoid a mix-up of different typologies. Logical foundations of those are not mutually exclusive and the origins of the concepts used by the discipline are traced towards epistemology, what is causing interdisciplinary confusion due to the lack of awareness and expertise in philosophy from the managerial side and lack of applied interest towards business need from theoretics of knowledge.

Similar bewilderment exists on the layer of structuring knowledge as was shown in the table above. We find that most commonly accepted and used models share the sense they insert in the staging and relationship between different stages but diverge on the limitations of them. For the purpose of the current research, it is focused on the Wiig's knowledge lifecycle model as a foundation because it pays significant attention to the organizational moment of knowledge (Mohapatra, Agrawal, & Satpathy, 2016).

The model was intended to adress knowledge in an organizational context – such preposition lines up with our pragrmatic research epistemology. Extreme simplification of the processess presented only to ensure common understanding. In real-life context processes ocures without a strickt order.

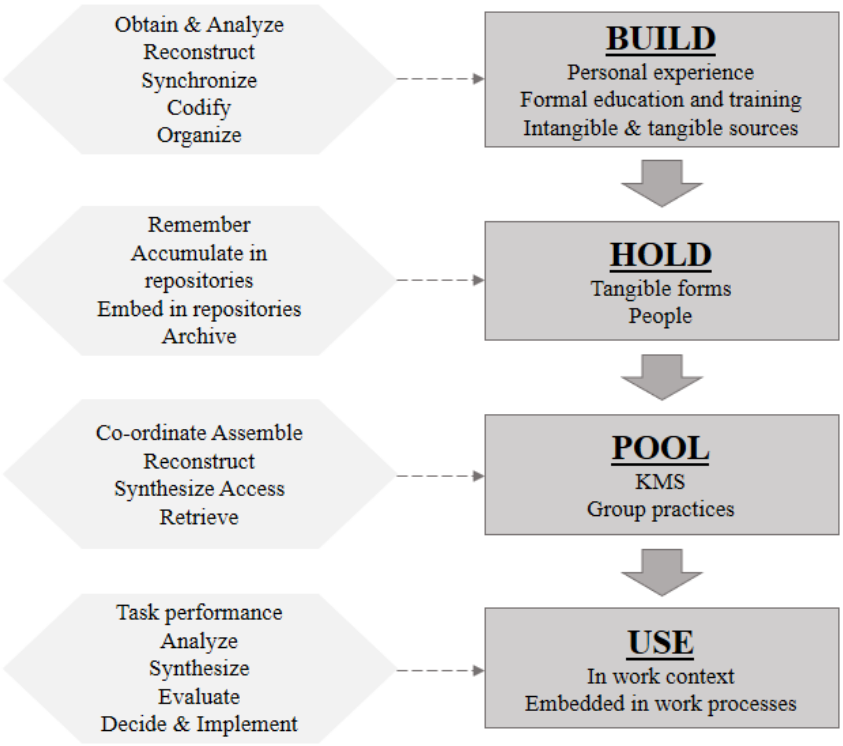

Figure 3. Wiig model. Adopted from Mohapatra, Agrawal, & Satpathy, 2016

An obvious drawback of this model is that it does not describe openly knowledge sharing, on which rely a crucial part of business incubation services on learning because it allows knowledge transfer on each stage. However, to ensure clearness in our research regarding KM systems we propose to withdraw the knowledge transfer into the distinct category, but only when discussion relates systems, not the knowledge cycle.

According to Lundvall (2016), ain outcomes of knowledge production are competence and innovation. We already dismissed innovation from the scope of our view, but the question of how competence should be build and transferred to the organization motivates us to continue our research.

1.2.2 Knowledge spillover theory of entrepreneurship

Knowledge spillover theory of entrepreneurship is a contemporary theory that argues that emergence of new firms, so rapidly growing for last decades, mostly connected to the knowledge possibilities that have appeared, particularly – to the knowledge spillovers (Ghio, Guerini, Lehmann, & Rossi-Lamastra, 2015). The theory, concerned with the reasons of knowledge

spillover from universities and R&D laboratories, argues that the knowledge flow is not streaming automatically and insists on the knowledge filters notion, which refers to narrow places within the flow that should be regulated and controlled. Putting it more simply, new venture appearance is not a result of a knowledge creation that occurred within a team, but rather a result of a knowledge exploitation from outside, and knowledge filters are those activities that either prevent valuable knowledge from the leakage or constitute knowledge flow with respect to the goals of sharing and creation.

Except for the legal and normative procedures that form the core of KMSE, the theory pays special attention to the structure of knowledge creation and sharing and highlights that major knowledge sources are R&D centers and incumbent firms. The number of research activities, such as studies conducted or even patents registered, does not have a direct influence on the number of new ventures, while the theory recognizes the particular role of human capital and tacit knowledge instead of codified.

Notable efforts were putted into finding a resource allocation model that allows to increase ROI to R&D. During them, it was claimed that entrepreneurial skills reduce risks of failure for a new venture (Acs, Braunerhjelm, Audretsch, & Carlsson, 2009). Furthermore, three systems contributing to knowledge creation were proposed: new knowledge (NKS), economic knowledge (EKS) and filter knowledge spillover (KFS). We would rather argue that those systems are parts of the one that produces knowledge and transform it into the state allowing to create economic value (Lugović, Šesnić, & Sladić, 2017). The same authors propose a notably idea of concentrating on the managing knowledge noise instead of knowledge by itself, at least, during the creation stage.

The reason we highlight this outline is the dual structure of knowledge transfer process in the business incubator: there are experienced and highly capable mentors on one side of the flow and immature incubatees on the other. From the profession side, they already possed an expertise and overcame the learning phase during which their universe was full of noises, while residents, we propose, are presented by people with high level of uncertainty within knowledge they possess and gaining. Mentors should be aware of such inequality in the prepositions of knowledge process actors and a strategy of transfer should rely on these considerations.

Additional justification of our proposal was brought in the study of influence organizational learning on the new firms' performance (Leiva, Alegre, & Monge, 2014). The study was conducted

within the scope of both knowledge spillover perspective and organizational learning theory and lead to conclusions on the importance of entrepreneurial, start-up founder, experience for the success of the company. The lack of practical experience thought to be compensated by entrepreneurial learning concentrated on strategy related activities, i.e on those connected to the strategic success of the firm.

Core idea of the knowledge spillover of entrepreneurship that «knowledge developed in some institutions might be commercialized by other institutions» (Senyard, Pickernell, Clifton, Kay, & Keast, 2008) in the light of the above lead us to conclusion that accurate knowledge management system has a capacity to improve performance of business incubator's firm: namely, through the knowledge flow (1) between mentors and incubees, (2) between external network and incubees and, possibly but not necessary, (3) between residential firms. Thus, there is a possibility to create and manage the inner and external knowledge spillovers through training managers and mentors to be the conduit of information flows.

To specify the reasons of interest towards KSTE, we highlight 2 of them, ignoring, innovation capability in the framework of this study, recognizing, however its potential:

- reduce the probability of failure for a new venture

- commercialization opportunities

An access to knowledge spillovers has a significant influence in shaping the success story of start-up companies, and business incubators, playing a crucial role in firm's performance, could substitute research centers and universities that thought to be the main source for knowledge development (Zibarzani & Rozan, 2018).

1.3 Knowledge Management Systems

1.3.1 Definition and Scope

Logically continuing the direction of the knowledge definitions, knowledge management system should be exposed from the systems approach, but with one refinement: any reference to KMS implies IT component as well, however, the importance and the degree of the focal point in the literature depends on the scope of the research. For the current one, IT element considered on a par with others without particular superiority.

Historically, there were different approaches towards the volume of KMS concept within the research field that could be reduced to two directions: technology-focused (Alavi and Leidner,

2001; Fink and Ploder, 2009) and organization-based (Corso, Martini, Pellegrini, and Paolucci (2003). The distinction is based on the focus and scope of the concept behind KMS: whether it more oriented on technology and IT related issues, such as different tools (databases, communication channels, expert systems, etc.) or on the organizational practices: knowledge sharing and creation activities. However, the synergistic approach was proposed based on empirical findings on the correlation between tools and practices (Cerchione & Esposito, 2017). This latest conclusion allow us to analyze KMS practices for the business incubator from both percpectives and in their interconnection.

Within the scope of synergistic approach, the given definition of the knowledge management system is a: «combination of knowledge management practices (KM-Practices), i.e., a set of methods and techniques to support the organisational processes of KM development on the one hand, and knowledge management tools (KM-Tools), namely specific IT-based systems supporting KM-Practices on the other» (Centobelli, Cerchione, & Esposito, 2018, p.109).

Considering tools without practices transforms the scope of attention into information technology domain and doesn't create any value for the organization by itself. Practices in their turn without respect to tools seriously limit their ability to form a competitive advantage in the VUCA world in technology-focused sectors. Thus, the synergistic approach allows to compensate lack of separated and to transfer the discourse to the strategic level.

With regards to strategy, the same authors bring out the taxonomy of the SMEs with respect to their KM strategy: guidepost, exploiter, explorer, and latecomer (Cerchione & Esposito, 2017). The belonging of organization to particular strategy depends on depth and breadth of KMS usage. It could be illustrated in the following way:

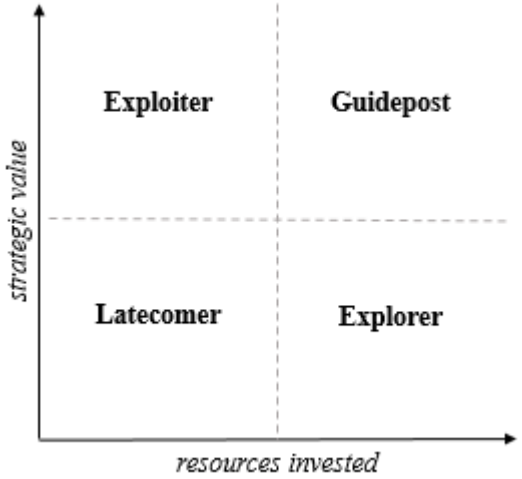

Figure 4. KMS strategy types. Adopted from Cerchione & Esposito, 2017

This framework allows describing business incubators' approach towards knowledge management systems implementation and application with respect to their perception of the value that knowledge management could create and their readiness and openness to innovations withing the field. It also opens a possibility to match their knowledge management strategy with that of incubees. The latest proposition is advisable on the stage of selection (if such is implemented by an incubator) and on the stage of designing a specific program for an incubatee.

In continuation of clarifying the knowledge management system notion and concept, explanation of KMS relation with knowledge is needed for the seeming evidence of such might be deceptive. First, we establish a difference between knowledge and information management systems to avoid confusions connected with possible misinterpretations.

Already mentioned perception of knowledge within a chain "data-knowledge" is crucial for this goals as it recognizes the foundation on which those systems are built conceptually: the one refers to information while the other – to knowledge. Information systems designed to handle the data and transform it into information, while knowledge systems operate more within a process "information-knowledge". Though the KMS could include an information system as a part of it providing a bigger chain of data transactions.

To justify the choice of KMS implementation for business incubators instead of IMS, we refer to the main incubation activities which are today connected to knowledge rather than information. First, the mentorship and an access to external network attribute to tacit knowledge as the benefits and value the mentor brings into a profect is based on the his or her expertise and interactions with a team, so his knowledge is subjective. Information systmes dealing with data are simply not designed for processing "hiden" or subjective data.[2] Second, as it was already mentioned, the needs of incubees lie in the field of the "know-how" knowledge rather than "know-what" and the former is atributed to knowledge management while the latest – to information

[2] We are aware of the possible exception that concerns the artificial intelligence application which enables to capture structured and concluded knowledge from raw data. However, as for now there is no evidence of such utilization in the incubation industry and it is very unlikely to appear in short-term, therefore we do not consider AI complication within the scope of current research.

management. Finally, we point out that a premise of the current paper is the possibility of gaining a competitive advantage with its knowledge management system. Information systems could be easily repeated by competitors, while KMSs, with broad tools and practices means, could be designed in a unique way with respect to the particular incubator needs.

1.3.2 KM practices

Attention towards knowledge management and its influence on the company's performance was rising for the last decades and eventually lead to a research on relationship particularly between KM practices realizing in the firm and its innovation performance (Inkinen, Kianto, & Mika, 2015). Used definition of practices is rather broad as it supports any activity that aimed to improve efficiency or effectiveness of the company's knowledge resources, but proposed categories of practices rely on the strong theoretic foundation and are presented as following:

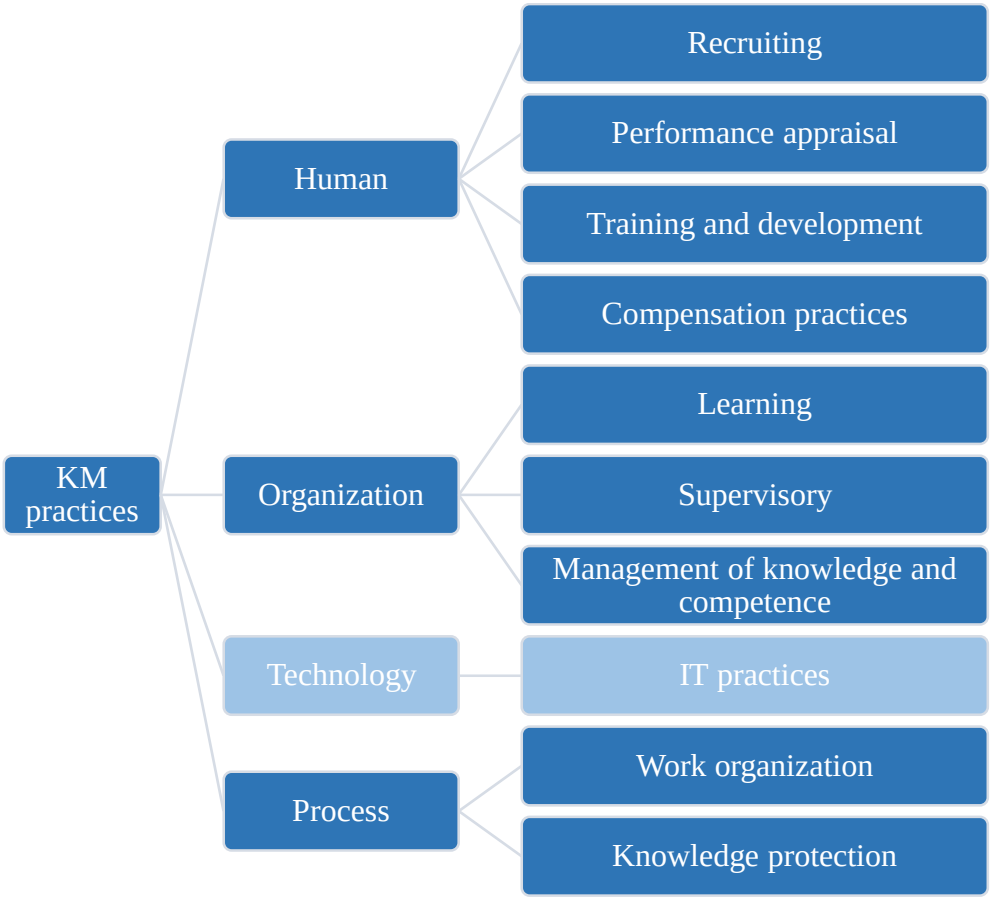

Figure 5. KM practices. Adopted from Inkinen, Kianto, & Mika, 2015

The presented structure inscribes ten commonly using practices into categories of orientation. A brief description of them, except for technology-based, will provide an overview of their role and possible interconnections while more explicitly we touch them in the empirical part

of the current paper. As for technology-oriented category, it is covered in the next subsection on knowledge management tools.

Human-oriented practices, or HRM, plays a crucial role in shaping human capital of the company. With respect to the incubation industry, HRM practices important both from the incubator's and incubatee's sides because it possesses instruments for forming an internal network of experts and mentors and for selection of residents. Of course, the method of matching a mentor with the firm is also based on HRM system integrated into the incubator.

The concept of organizational learning is also tied up around knowledge and describes learning as a consequence of repeated practice or observations: so these practices cover both tacit and explicit knowledge and could bring an effect of scale within the collective. Supervisory practices took the place within organization scope due to its strategic direction and foundation in shaping the organizational culture. Knowledge and competence management refers to the strategic planning and monitoring constructed across knowledge resources.

Work organization practices are those shaping the inner organizational processes with particular attention to decision-making authority and responsibility distribution. Knowledge protection corresponds with attempts to prevent imitating and ensure the appropriability of intangibles-based profits.

Influence of several of mentioned practices or categories could be confirmed through the connection with factors earlier were founded to be statistically significant for projects' success even, namely, knowledge strategy and structure, motivation and commitment level, IT structure, organizational structure and culture, senior management support, learning organization, clear goals and purpose of KMS, regular impact monitoring and security protection (Jennex, Smolnik, & Croasdell, 2007).

Outstanding classification of people-based practices was proposed by R. Grant (2013): communities of practice (sharing and learning networks), best practices groups (expertise network), virtual teams (horizontal coordination), peer-review groups (lessons learned methodology), KM and HRM training. Here we highlight the particular concentration of practices in knowledge management across human and strategic organizational focus for future considerations with respect to the incubation industry.

The theory presented by Nonaka (1994), which already became classical, describes a continual dialogue between tacit and explicit knowledge which drives the creation of new ideas and concepts. He introduces four different modes of knowledge conversion: socialization, combination, externalization, and internalization.

According to this theory, known as the spiral model, the key to the process of creating tacit knowledge is through shared experience - socialization. Socialisation could be implemented in forms of observation, imitation, and practice. The second type of knowledge conversion involves the social processes that combine different explicit knowledge that is held by individuals, who exchange and combine knowledge through meetings and telephone conversations; this process of creating explicit knowledge from explicit knowledge is referred to a combination. Both third and fourth categories of knowledge introduce the idea that tacit and explicit knowledge are complementary to each other and transformed through a process of mutual interaction. Externalization refers to the conversion of tacit knowledge into explicit and internalization, vice-versa, transform explicit knowledge form into tacit.

Within the scope of this framework, there is an argumentation that incubators should develop a system of knowledge creation or spiral of knowledge, where learning takes place within the structure of the firm's mission and strategy to support the growth and long-term survival of the incubation firm (Hennessy, 2012). The logic of such argument is based on the recognition that entrepreneurs expect any risk to be minimized to proceed in business.

Besides, it was founded (U. S. Department of Commerce Economic Development Administration, 2011) that top-performing incubation programs tend to have the written mission statement, selecting clients based on cultural fit, selecting clients based on potential for success, reviewing client needs at entry, showcasing clients to the community and potential funders. Such a result is explained by efforts that a business incubator put towards it organization and human-focus practices on the levels of selection, performance appraisal and creating an active external network for incubees.

1.3.3 KM Tools

In this section, we analyze technology-based tools for managing knowledge. There are few approaches for tools systematization: phase-based, which advise tool upon the step of knowledge process where it would be implemented, or function-based, which group tools on the principle of the main feature it has.

R. Grant (2013) firstly use functional approach and propose the following division: databases (knowledge memory), software (navigation), portals (access) and groupware (collaboration). We distributed them with accordance to Wiig cycle[3]:

Table 5. KM technology-based tools distributed to the correspondent KM stages

KM stage	Examples of the options
Build	Groupware
Hold	Databases; data warehouse
Transfer	Groupware, portals
Use	Software, portals

Technical tools commonly adopted by SMEs for today are: conferential tools, social media, cloud-computing, chats and e-mail, databased, content management systems, ERP, Wiki, reputation systems, product lifecycle systems, learning management systems, peer-to-peer sharing, mash-up, crowdsourcing, data management and data mining systems, document management, etc. (Centobelli, Cerchione, & Esposito, 2018).

The other approach towards tools is based on the tacit-explicit dichotomy of knowledge that is discussed in the the section 1.2.1 "On the concept of knowledge". As the knowledge could be converted from tacit to explicit form and shared among people in the organization, was introduced spiral or SECI model by Nonaka (Xu F., 2013). The model describes four processes each of which occurs on the corresponding stage of knowledge transformation or sharing: socialization (tacit to tacit), externalization (tacit to explicit), combination (explicit to explicit) and internalization (explicit to tacit). Following table provides with examples of tools that could be used for each transformation.

Table 6. The four Knowledge Conversion Models (Bandera et al. 2017)

[3] This note is designed to remind that the category "transfer" was not originally presented in the Wiig model, but we introduced it in the section 1.2.1 "On the concept of knowledge" as a necessity to consider when constituting knowledge management system.

	To tacit	To explicit
From Tacit	*Socialization*	*Externalization*
	• Knowledge maps • Knowledge portals	• Groupware • Workflow • Knowledge-Based Systems • Knowledge Portals
From Explicit	*Internalization*	*Combination*
	• Innovation Support Tools	• Inranet • Electronic Document • Management • Business Intelligence • Competitive Intelligence • Knowledge Portals

The SECI model was analyzed to foster innovation process lately due to prevalent models of entrepreneurship (Bandera, Keshtkar, Bartolacci, Neerudu, & Passerini, 2017, and Li, Liu, & Zhou, 2018) but we consider innovations to be meanly important for start-up companies that resort to incubation services. However, such interest attests high applicability of the model to for the knowledge creation process, which lies in our focus of our attention, and SECI model was understudied in SMEs context. It was founded that start-ups do not concentrate more on the internalization at it was expected by researchers and confirmed that externalization and combination on average is lower in startup firms (Bandera, Keshtkar, Bartolacci, Neerudu, & Passerini, 2017) and concluded that entrepreneurial KM practices more attracted toward eastern tradition of KM distancing them from the "systems and tools" approach of the western KM tradition.

This finding increases applicability and relevance of the model for our current research: not only it focuses on the knowledge creation, transfer, and application strategies, but also changes the direction of a framework for designing KMS from technical point towards tools listed in the table above. Socialization was founded to expose higher level than combination, that higher than externalization, which, in turn, is higher than socialization for start-up firms. Meanwhile, the

volume of listed tools in the tacit section is bigger than in the explicit part, what could be a signal of significant development of tools for tacit knowledge.

The context of tacit knowledge meanwhile provides us with difficulty of designing such tools because of characteristics of it: informal nature, intuition-based, subjectified and difficult to codify. However, the solution could be hidden within external practices: «For example, in addition to shared spaces with common activities in incubators, entrepreneurial meet-ups are booming in cities around the world to favor elicitation of implicit assets, and build a community. Indeed, building implicit assets is a key function of entrepreneurial ecosystems» (Bandera et al. 2017).

1.4 KMS alignment with business incubators

The purpose of this subsection is to investigate an internal alignment as the ability of an enterprise to align organizational and knowledge management processes with its infrastructure. With respect to ICT, it was founded that enterprises successfully aligning their business strategy with their ICT strategy outperform those that fail. Tseng (2008) stated that an enterprise should align its knowledge management systems (KMSs) with the nature of its knowledge if it is to be efficient and effective since the KMS is the mechanism that an organization creates to make the flow of work more efficient. However, there is a lack of researchers dedicated to the problem of KMS alignment (Centobelli, Cerchione, & Esposito, 2018), all the more so in the context of SMEs.

Towards the implementation and application of KMS, important to design a model with preoccupation about two most common issues: inefficiency and ineffectiveness. The former refers to a problem of underuse of KMS and the latest corresponds with unsuitable for the business choice of KMS. Centobelli et al. (2018) propose a model for KMS alignment within an organization aimed to transfer and asset-based focus towards knowledge management into liability-based. Structurally, the model is built with respect to influence KMS has on the firm's performance through its direct connection with knowledge asset.

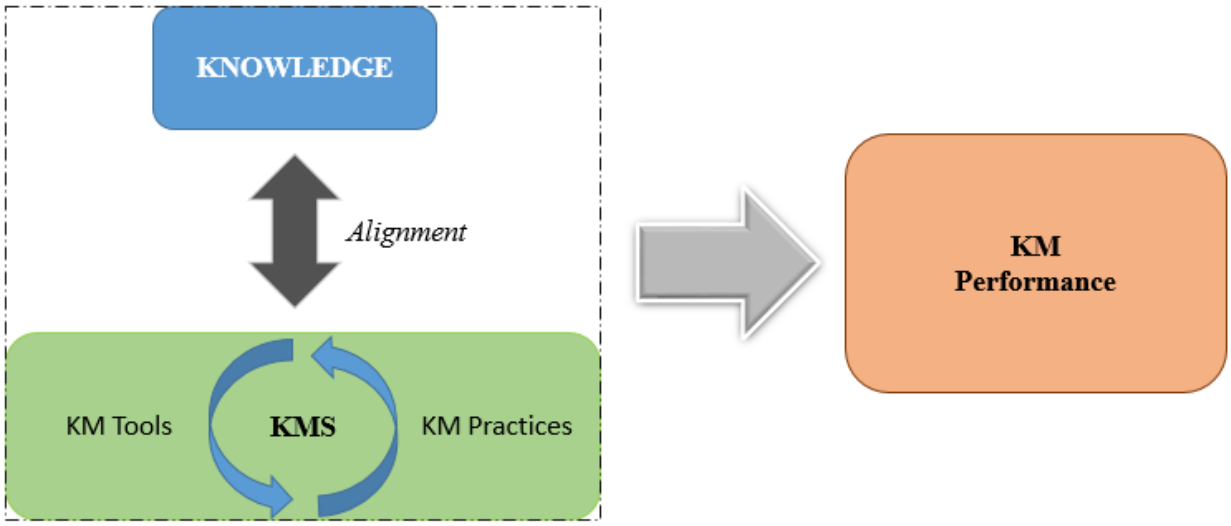

Figure 6. KM alignment. Adopted from Centobelli, Cerchione & Esposito, 2018

SMEs, as well as start-up firms, thought to be more likely to operate knowledge informally (Hutchinson & Quintas, 2008), and there are two controversial directions for strategic knowledge management: one suggest that switching towards formal systems and procedures would maximize benefits for the company, while another propose to supervise human-based practices under direction of chief knowledge manager (Centobelli et al., 2018).

Particular consideration deserves the discourse around network creation. Quality of interaction is one of the major factors contributing to teamwork and decision-making process, and the quality of social ties of team members contribute to communication character and knowledge sharing. Findings testify that (1) personal communication among residents enhance improve services, but (2) abundance of connections do not contribute to knowledge exploitation, however (3) the quality of connections do influence on it (Zibarzani & Rozan, 2018). Thus, it was concluded to be reasonable for a business incubation industry to concentrate efforts on building a networking hub.

Aligning KMS with a business incubator, necessary to distinguish epistemological and ontological layers of knowledge (Centobelli et al., 2018). We already touched the epistemology in distinguishing tacit and explicit forms of knowledge. Ontology here is recognized as the structured summation of agents involved into particular knowledge domain. It could be

distinguished on the level of subjects: individual, inner-group, organizational, inter-organizational, etc.

1.5 Conclusions of the Chapter: research gap and questions

Conducted analysis of academic perspective on the knowledge management systems from incubation point of view revealed lack of researchers designated to the topic. However, the knowledge management domain is considerable developed and offers a range of theories and framework that was commonly accepted and applied to other industries and subject areas. As regards business incubation industry, we found that academic attention towards it mainly caused by practical interest, and current paper is no exception.

The peculiarity of knowledge management and business incubation intersection is that the industry manages knowledge as a strategic asset, but a business model of BIs does not imply a direct relationship between the profitability of the organization and KM. Nevertheless, a range of non-financial benefits seemed to rely on the knowledge capability of the incubator: its brand-image, success rate among residents, etc. A typical business incubator provides consulting services, facilities and creates the entrepreneurial environment to help businesses to develop and establish itself (Lewis D., 2001), wherein all these support activities a tenant receives on a rental payment basis without regards to the volume of services received. The other financial source for a BI is a public sector support.

A practical purpose to overcome the scarcity of the research on the subject is caused by a positive and nutritious effect that the business incubation industry experts on the local and world economies. It does not only boost the entrepreneurship and creates new jobs worldwide, but also increase innovation ability. The latest accounts for public support and corporations interest towards business incubators.

To identify research gap we propose a following structure of KMS alignment between knowledge and a business incubator with main concepts and relations derived from literature analysis (Centobelli et al., 2018; Zibarzani, M., & Rozan, M, 2018; Inkinen, Kianto,& Mika, 2015) dedicated to both topics.

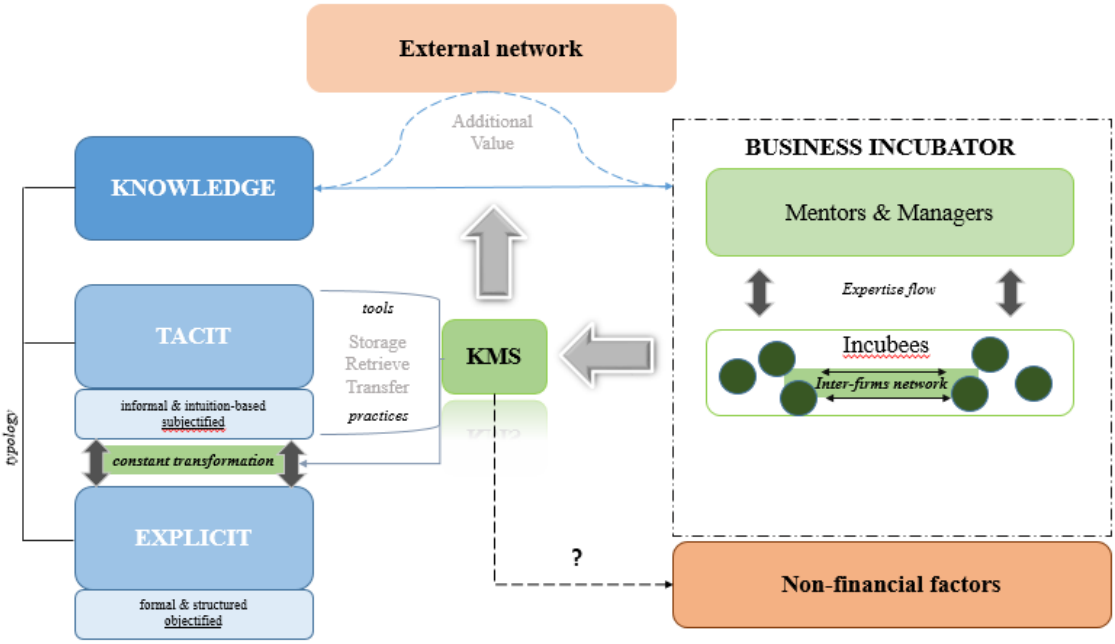

Figure 7. KMS alignment with a business incubator. Source: author's own

The scheme illustrates relationships that KMS' task is to support: the processes of knowledge creation (in terms of tacit-explicit spiral), transfer (between incubatees, mentors and incubatees, external network and incubatees, external network and mentors/managers of an incubator), storage and retrieval with respect to all mentioned knowledge sources and agents. We suppose that KMS, taken both from practices and tools perspective, has an ability to positively affect a non-financial performance of the business incubator through its influence on the quality of services and inner culture. This conclusion we made based on the study conducted recently (Inkinen, Kianto,& Mika, 2015).

The research problem is an absence of an actual image on the state of knowledge management practices and tools implemented in business incubation industry. Although it is reasonable to assume that knowledge management plays a crucial and even strategic role for a business incubator and its residents, we cannot construct any models and theories without exploring a current state of affairs.

The main research question, as it follows from the gap and practical advantages of knowledge management systems, is the following:

- *How knowledge management systems, taken as practices and tools, are implemented in business incubators?*

Sub Questions that lead us to the resolving the main issue we formulate as these:

1) *What is the state of current usage of knowledge management tools and practices in business incubator?*

   – to evaluate tools and practices actually applying

2) *How business incubators perceive a role of knowledge management system for their business?*

   – to explore business incubators' perception of knowledge management practices and tools

Listed questions with their goals allow to develop a knowledge management system that could be successfully integrated in the business incubator to manage its knowledge processes and improve non-financial performance as they, conducted in exploratory manner, provide an understanding of business incubators' needs and obstacles in facing knowledge management.

Chapter 2. Research design and methodology

2.1 Research methodology

Research philosophy considered to be a foundation of the study because it not only able to demonstrate school affiliation of an author but also underlies and guide his research logic and behavior (Saunders, Lewis, & Thornhill, 2012). Four schools of thought could be distinguished: positivism, realism, pragmatism, and interpretivism.

Positivism is constructed on the premise that knowledge communicates something about the world's structural laws and, even deeper, that it is possible to communicate something about the object of study, i.e. the object already possesses characteristics and features that could be studied. Positivism underlies physical sciences as it is empirical in its nature. The role of the researcher is irrelevant for the study if it is conducted in an uninfluential way, independently. Unempirical studies and knowledge positivism recognize as not having scientific value, as knowledge creation possible only through deduction.

Realism is also based on the premise of existence objective knowledge, but it also values theoretical constructions about the world. Thereby, if positivism relies only on the predictive analysis that based on the repeatability of phenomena, realism is also intended to discover underlying conditions which not necessarily break out into the physical world, but determine the latest.

Interpretive schools introduce a passive role of the researcher in the study as the reality, objective by its nature, can be known only by a subject of cogito, so the process of cognition shapes a knowledge. Reliability, as more positivistic concept, could not be reached to the full extent.

Pragmatism might seem to be the most advantageous since it does not tend to demonstrate exclusivity of the position it takes. It is based on the warring assumptions of positivism and interpretivism: the same conclusion about the object could be reached by others since the ultimate cognitive goal is to establish a plausible judgment, but in the same time, since cogitation is subjective and the world is dynamic, the common recognition it not guaranteed or it could be changed in time.

The nature of the current research is exploratory, which is caused by academic scarcity related to knowledge management systems through the lens of business incubation needs. Fundamentals from which design of the research is drawn are grounded in the pragmatic epistemology the author stick to (Creswell , 2009), which the observant reader could already notice from the "how" and "what" focus of the research questions. We believe that pragmatic epistemology is the most co-sounded with contemporary studies on the knowledge from the organizational perspective as those studies place the concept of knowledge within the context, which is an organizational structure, rather than attempt to investigate it as a "thing-in-itself" (Blosch, 2001).

Reasoning approaches usually follow a theory of knowledge chosen by a researcher. We already introduced a deductive approach, according to which, movement of thought is implemented from the general laws or observations to a particular conclusion. Induction, on the contrary, leads a though from particular to general. Abduction in social sciences deals with an interference in which the middle element of thought, the glue between conclusion and premise, lacks.

As reasoning approach that continues pragmatic direction, this paper relies on the abductive inference introduced by C. S. Peirce (Xu & Li, 2011). The need underlying the use of the abductive mode is explained by the situation from which we started our research odyssey: an absence of theories that explicitly would connect knowledge as a strategic asset possessed, transferred and created by the business incubator with the instrument which supports its applying, namely knowledge management systems. To avoid academic prostration connected with lack of foundation, we need to introduce premises on which KMS could be configured to be able to proceed to further inquiries: «Grounded in the fixation of beliefs, the function of abduction is to look for a pattern in a surprising phenomenon and to suggest a plausible hypothesis» (Yu, 2006, p. 6).

Such premises could not be verified a priori, because knowledge management as an organizational discipline does not appear from the clear reasoning, but rather is based on the conclusions that were founded to be reasonably drawn from the experience. Since there is no or very limited academic experience related to the incubation industry, we cannot apply the same logic of deduction (that something must be) to current research. Induction (something actually is) is not applicable as well because premises of the study are based on expectations rather than a

results, so a posteriori models of reasoning better be avoided to save the principle of falsifiability and demarcate scientific basis of our paper (Xu & Li, 2011). Abduction gives an opportunity to generalize, as induction, but limit the procedure to the context of research non-pretending to establish common laws.

Pragmatism also allows to incorporate mixed methods in the strategy of inquiry and combine interviews with a survey. Such approach assessed to be beneficial due to its ability to satisfy two dimensions of our research problem in a concurrent way: to measure the extent to which knowledge management systems being used and compare situations "as it" with "to be" and to gather an understanding of the value that is expected from KMSs, i.e. business drivers.

Limitations of the current research possibilities were considered to construct the concurrent triangulation design: it was expected that both usage and apprehension of possibilities the proper knowledge management system are underestimated and underused.

The first research sub-question "To what extent business incubators use knowledge management systems?", aimed to explore tools and practices actually applying, we divide into two sections: the first, questionnaire-based, designed to demonstrate an actual breadth of KMSs that used in incubation industry. The results disclosure the possibilities for development and improvement for business incubators, as well as for accelerators and technoparks that usually include part of incubation activities. Second supporting part supposed to be conducted within interview process for the conversation allows to get a context of knowledge processes and flows. Thereby it is possible to assess an expertise level of a contact person within the field and, consequently, to adjust the speech and concepts used, to clarify narrow places and to judge whether KMSs is undeveloped or simply have a low relevance in terms of services offered. Parallel clarification within the extension assessment is not required since concepts and terms used are rather commonly adopted.

Touching the first question in interview also considered playing the role of the connector and bridge for mixed research. Preoccupied with considerations of possible influence that gathered data might have on the perception of the author and on the interview procedures, we decide not to summarize survey findings until the finish line of the interview process.

The second question is completely qualitative due to the focus on the perception and personal appraisal. We aware that valuation for the business could not be substitute with those from the contact person, so particular interest was driven by advantages of comparison based on

the function the person responsible for in the business incubator and validation of results. The mixed method is used to improve quality of the research, thus expected value of the current work is worthy of attention (Jack & Raturi, 2006).

As for data analysis techniques, case study was considered an opportunity to create a full picture and assess it from organizational side, but for our research to provide reliable results with respect to the industry at least 5 case studies would be needed, what is not possible under current research as long as the research is trying to draw conclusions and theory on the global level rather than local and is concerned with the topos in the whole industry. Limitations of case-study that cannot generalize the results to the wider population, is difficult to replicate and time consuming, excludes this as the option. The other limitation is motivation-related: to gather few case-studies it is necessary to ensure or create full motivation from companies, and organizations do not tend to participate in time-consuming activities that would not bring immediate result. Master thesis under this light is not the study that has high possibility to satisfy this condition.

The conjunction of a survey with interviews, in an opposite, can compensate each other's limitations and give us a power to draw conclusions on the international level and gather valuable insights from analyzing people' perception and motivation that would allow creating a foundation for future researches.

Table 7. Research summary.

research philosophy	*Pragmatism*
research approach	*Abductive Inference*
data analysis type	*Exploratory*
research design	*Mixed Methods*
inquiry strategy	*Concurrent Triangulation*
data analysis techniques	*Interviews and survey*

2.2 Survey construction

For the current research the survey cannot be an independent and sufficient technic for heading towards the conclusion for following reasons: (1) a limited access to population and, as a

result, small sample that is statistically unreliable and illegitimate to generalize, (2) construction of the survey – to get the most complete picture on the extent of practices and tools, we would be needed to list out the whole range, increasing the lengths of the survey, what results in the decreasing response rate.

Challenge with population is based on the requirements we present to participants:

- a business incubator should exist on the market for more than 3 years so that at least one wave of graduates was released;

- an incubation program should last from 1 to 3 years: if it lasts less than a year, than, even it could be named an incubation by the company, the program is rather accelerating according to the time and stage-based classifications;

- a respondent should possess an experience in the company more than a year;

- a respondent should be able to speak either English or Russian.

Such limitations decrease the number of incubators to which we can distribute the survey as part of them are working only on the regional level and are not interested in building international relationships. In the process of gathering the database, it was also noticed that approximately 30-50% of incubators[4] that could be searched in second sources either are not consistent with the concept of incubation and focus more on venturing or accelerating or even do not provide any entrepreneurial services.

Developing design of the survey, we were focused on the following conditions: theoretical consistency with the framework of Inkinen, Kianto, & Mika (2015), we discussed in the 1st chapter, and reliability of the construct in terms of previous conductions. Among available researches both on practices and tools we found as the most relevant and consistent a survey on financial and non-financial implications on the companies (Luhn, Aslanyan, & Leopoldseder, 2017). Since we are not interested in the financial performance yet however, in our opinion, KMS indeed may influence financial performance of the company, but not directly – due to the business model of incubators and rental-based or funding income, but might have more direct influence on non-financial ones, we eliminated financial indicators from the scope of our analysis. To strengthen up the survey, we

[4] This is author's own perception and estimation could vary on the country. Moreover, for some countries due to seemingly undeveloped incubation culture there are no sources with lists of operating business incubators and the search was conducted manually through web search engines and search opportunities of social medias, included LinkedIn.

also added question on the business advising capability and took into consideration a survival rate among the incubator's graduate as a performance indicator as well as questions on the residents' satisfaction with services and programs. Due to overload of the questionnaire we had to eliminate construct on organization structure centralization from the original survey as those questions concerned mostly employees, while our main focus is incubatees and mentors.

As a scale was used 5-points Likert scale: it was used in the researches we are built on our and there is an evidence that data becomes significantly less accurate when the number of scale points drops below five or above seven (Carifio, 2007). Design of the statements supposed that a respondent has to assess the extent of his agreement with it, and we used the following designations: "strongly disagree, disagree, neutral, agree, strongly agree".

We distributed the survey online – for this purpose we spent two weeks creating database of relevant business incubators that had any online presence expressed in our working languages. Also we had to check an information and peculiarities of the programs to distribute the survey strictly among incubators. Besides, we eliminated University-related incubators to avoid confusion in the results that might be caused by knowledge spillover theory of entrepreneurship we discussed in the 1st chapter. Finally, the list of 250 companies worldwide was gathered.

Table 8. Items and construct assignments (Luhn et al., 2017, and Inkinen, Kianto, & Mika, 2015

Construct	Items (Luhn et al., 2017)	Question	Connection to Practices Framework (Inkinen, Kianto, & Mika, 2015)
Information Technology IT Support	Information sharing via Intranet	Our company provides intranet for information sharing:	IT Practices
		- among employees	
		- among residents	
		- between employees and residents	
	Knowledge map for knowledge source	Our incubator provides 'knowledge map' for knowledge source finding and accessing.	
	Use of Customer Relationship Management (CRM)	Our incubator provides CRM – Customer Relationship Management for customer information gathering.	
	Use of Data Warehouse	Our incubator provides Data Warehouse or knowledge repository for knowledge acquisition.	
	IT support for information acquisition	Our incubator provides IT support (e.g., groupware) for information acquisition.	
Organisation Culture Learning	Clubbing and community gatherings	Our incubator provides various programs such as clubs and community gatherings for residents.	Training and development
	Formal training programs	Our incubator provides various formal training programs for performance of residents.	
	Contents of training	Our residents are satisfied by the contents of training or self-development programs.	Training and development
	Encouragement to attend seminars etc.	Our incubator encourages people to attend seminars, symposia, and so on.	Training and development
	Informal individual development	Our incubator provides opportunities for informal individual development other than formal training such as networking events, informal mentoring.	Training and development
	Business advisors	Our incubator has access to the right local people who can facilitate the acquisition of key competencies.	Training and development

		Our business advisors are really interested in learning all about new and emerging support practices.	
		Our incubator has experienced business advisors.	
		Our incubator has specialized business advisors.	
People T-Shaped Skills	Knowing core knowledge	Our incubator employees know core knowledge needed in their own tasks.	Management of Knowledge and competence; Work organization
	Employees expert in their tasks	Our incubator employees think that they are expert in their own tasks.	Management of Knowledge and competence
	Employees can explain their task	Our incubator employees can explain their own tasks to others.	Management of Knowledge and competence
	Employees having accurate know-how	Our incubator employees can know their own know-how accurately.	Management of Knowledge and competence
Knowledge management processes	Accessing valuable knowledge	Our incubator stresses on accessing valuable knowledge from external sources.	Management of Knowledge and competence; Learning
	Using knowledge that is accessible, in decisions	Our incubator emphasizes on using accessible knowledge in decision making.	Management of Knowledge and competence; Learning

	Embedding knowledge in processes	Our incubator stresses on embedding knowledge in processes, products, and/or services.	Management of Knowledge and competence; Learning
	Representing knowledge in documents etc.	Our incubator emphasizes on representing knowledge in documents, databases, and software.	Management of Knowledge and competence; Learning; IT practices;
	Facilitating growth of knowledge	Our incubator emphasizes on facilitating knowledge growth through culture and incentive.	Management of Knowledge and competence; Learning
	Generating new knowledge	Our incubator stresses on generating new knowledge.	Management of Knowledge and competence; Learning
	Determining the knowledge assets' value	Our incubator stresses on measuring the value of knowledge assets and/or impact of knowledge management.	Management of Knowledge and competence
	Transferring existing knowledge	Our incubator focuses on transferring existing knowledge into other parts of the organization.	Management of Knowledge and competence; Learning
Non-Financial Factors	Higher survival rate	Compared with key competitors, our business incubator has higher survival rate among graduates.	-

	More customer acquisition	Compared with key competitors, our incubator has more creation of new clients.	-
		Compared with key competitors, our company has higher occupancy rate.	
	Incubatees satisfaction	Compared with key competitors, our company has greater incubatees growth.	-
		Compared with key competitors, our company has higher service utilization rate (percentage of companies using incubator support services).	
		Compared with clients of key competitors, our incubates are more satisfied.	
		Compared with key competitors, we offer a wider range of support services to incubatees.	

2.3 Interview composition

Almost complete uncertainty about knowledge management practices and tools implementation and about recognition of those lead us to necessity conduct a set of interviews to discover (1) how familiar are business incubators with knowledge management, (2) their perception and valuation of it, (3) possible reasons of the current state of KM practices and tools and (4) opportunities for the industry they hide.

As the most useful format for purposes of our research and applicable in its conditions was chosen the semi-structured interview with open ended questions. This type of interview is not highly structured, as is the case of an interview that consists of all closed-ended questions, nor is it unstructured, such that the interviewee is simply given an indulgence to freely discuss the topic without core focal points. Semi-structured interviews offer topics and questions to the interviewee and should be carefully designed to elicit the interviewee's ideas and opinions on the topic of interest. For current research, semi-structured interview is supposed to help develop an understanding of the ways in which managers and owners of business incubators create meanings about their inner environment and it relations with knowledge management systems (Sandy Q. Qu, 2011).

Thus, the focus of this subsection is on the creation of interview plan that would incorporate themes to be covered during the interview to direct the conversation toward the topics and issues about. As a guidance, we started with detailed contemplation on the type of questions that could be useful to uncover the topic: introducing questions, probing and specifying questions, indirect questions (to map his or her perception) and throw away questions. Concepts and topics to be covered were mind-mapped in order to establish possible movement of questions with dependence on flow of conversations as it was expected to conduct informal interviews through the VoIP and phone calls. The choice of channels was influenced by geographical limitations – as we aimed to study an overall utilization of KMSs, physical attendance of researcher during conversations was complicated.

The topics to be covered are presented in the following figure and they formed three layers reflecting our expectations from interviews: the questions on the current usage are rather structured and the theoretical structure rarely varies between industry, while there is no information on perception and overall familiarity of the knowledge management concept.

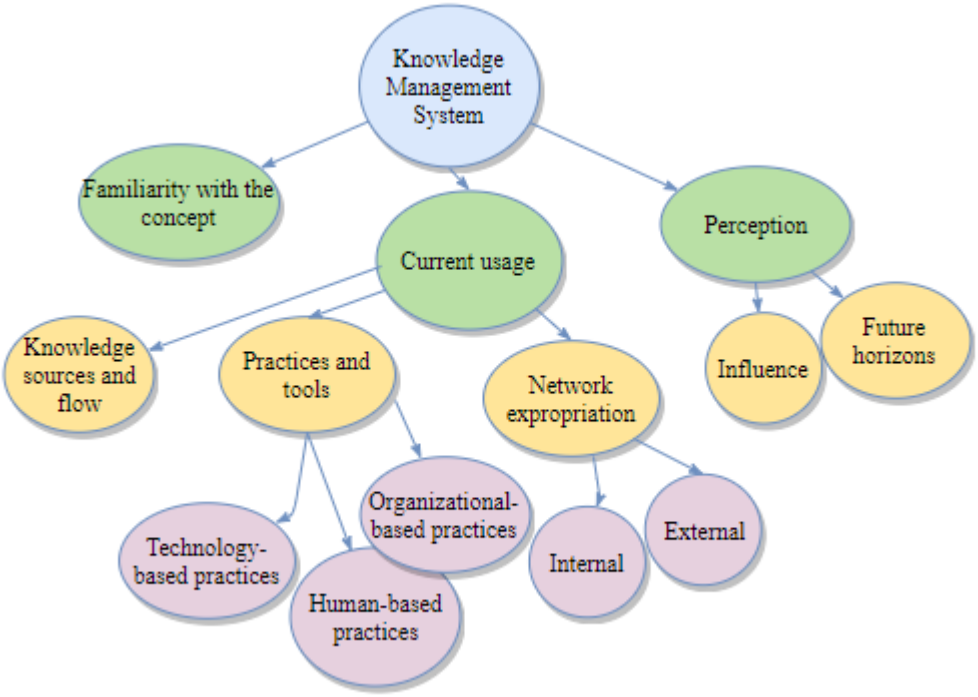

Figure 8. Interview topics map.

The following questions was developed as guidance for an interview process:

Table 9. Interview guide questions

Question	Purpose
What associations come to your mind when you hear “knowledge management”?	To collect personal perceptions and highlight most common. To reveal the level of familiarity of interviewee with the topic.
Could you please describe what tools are used in your incubator to collect knowledge? To transfer? To store?	To get an understanding of the level of IT based tools – their scope, maturity and needs they cover.
How you manage and develop training programs for residents? Who is responsible for this?	To get insights on human and organizational based practices. To unhide external/internal network topic.
How mentors work with a resident? Does resident receive help of other employees?	Explore external and internal network expropriation.

What distinguish you from other incubators?	To understand how they treat knowledge assets – whether it plays crucial role or not.
Which factors, among financial, influence success of the startup?	To understand the perception of the role of knowledge tools and practices among other factors.

2.3 Survey discussion

The survey were distrubuted online via e-mail to business incubators adresses of which were gathered through user-created databases available online and gathered 14 responses. Demographical data on the participants is: male – 36% and female – 64%. Most frequently participated age group is 26-35 (6), then 36-45 (3), 46-55 (3) and 18-25 (2).

Countries participated in the survey: Italy (2), India (3), Ukraine (1), Canada (1), Russia (2), Republic of Belarus (1), Kazakhstan (1), Singapore (1), UK (2). The survey was also distibuted in USA and Israel, but those countries didn't participate.

People, who participated held the following possitions: regional director, head of operations, co-founder (2), CEO, Startup Selection manager, investor relations leader, project manager(2), account manager, business consultant, international relations manager, business development manager, director.

To assess an inner consistency of the survey we runned Chronbach's alpha function in R and received the following results on the interitem validation for the each construct:

Table 10. Chronbach's alpha

Construct	IT Support	Org. culture& learning	People T-Shapped Skills	Business advisers	Knowledge management processes	Non-Financial Performance
α	0.67	0.89	0.87	0.88	0.95	0.9

Usually, Chronbach's alpha is used for running a factor analysis, which could not be done in our case due to small sample size. However, Cronbach's assess the internal consistency for all

the construct except for IT Support. It is believed, that for theoretical research consistent interval strarts with .8 or 07. IT Support in our case has only .67 value which might be interpreted as reasonable or adequate (Taber, 2017).

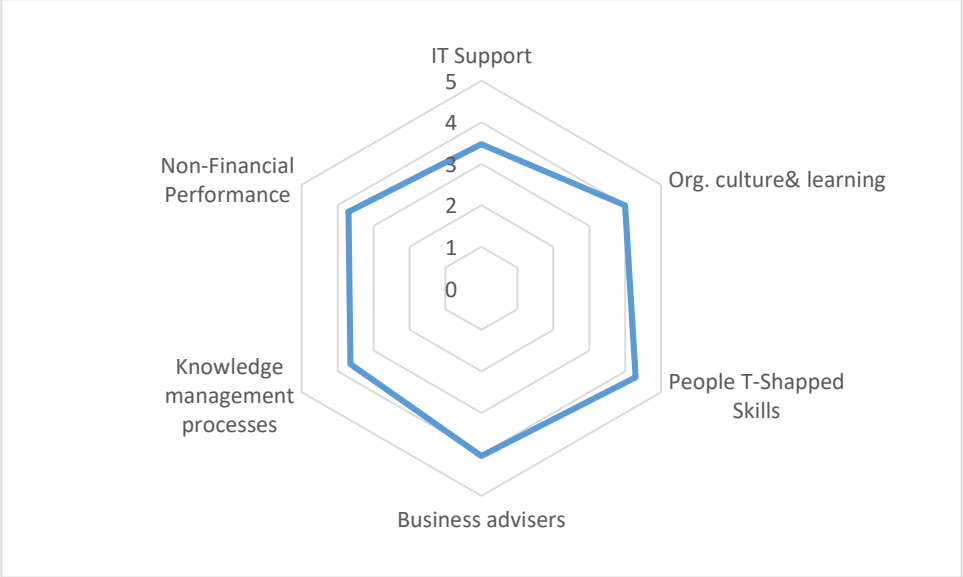

Figure 9. Accumulated factors

Results of analysis demonstrate a possibility for improvements, however, on average it doesn't seem crucial. We can observe that most low results are in the constructs of IT Support, Knowledge Management Processes and Non-Financial Performance. Our survey lack statistical significance to run a regression model, but we still can investigate those factors more in detail to combine this data with results of our interviews.

The low results in IT support construct are based on rare usage of CRM, knowledge mapping technics and intranet for residents. Knowledge management processes indicate a low quality of transferring knowledge support, decision-making, knowledge depository and facilitating knowledge growth. Moderate, but still low results were shown on the measuring the value of knowledge assets and/or impact of knowledge management.

Regards non-financial performance construct, results on survival rate were rather high (mean – 4.5), but utilization rate (percentage of companies using incubator support services) is almost critical – 2.8. Occupancy rate and client creation both have a mean of 3.5. Such situation idicates that BIs migh be underused by companies – however we cannot conclude on the reasons yet. If we had low utilization rate, but high occupancy, it would imply that startups use business

incubators as a source of comparatively cheap offices, but it's not the case. We assume that reasons for such result should be investigated with respect to residents as well.

To conclude, the findings of the survey indicate a possible underuse of tools and applications available for the business incubators industry as well as propose zones that should be considered for development: knowledge process based practices and IT component.

2.4 Interview discussion

Interviews were conducted to distinguish common perceptions and concerns on knowledge management systems in business incubators. Sampling conditions from survey were enhanced so that the contact person should also possess either a significant experience in mentoring (more than 5 years), or should held a leading position in the following areas: business development, project management, training programs or C-level position. The restriction is caused by the deepness of insights the author was expected to gain from open-ended questions, unlike the closed, which were used to construct the survey as it was designed to get a description rather than a deep understanding from the participants. As a searching source, we used social media and LinkedIn, resulting in 11 conducted interviews with duration from 10 to 20 minutes. Time variance is caused by different level of openness and desire to express an opinion from interviewees.

Table 11. The list of participants.

Interviewee	**Position**	**Country**
1	Director	Russia
2	Projects Leader/Coordinator	Russia
3	Founder	USA
4	CTO	India
5	Business development officer	India
6	Co-founder, CEO	Singapore
7	Mentor	Italy
8	Program coordinator	Canada
9	Head of ecosystem development	England
10	Managing director	Pakistan
11	Head marketing and communications	Germany

To comply with ethical considerations, interviewees were warned about the goals of the conversation and publicity of the research. They were also familiarized with confidentiality possibilities and desirable time limitations of the interview. Although almost half of the participants did not mind about revealing their personal information, we find it unethical due to the uncertainty of others.

Although we didn't have a goal of distinguishing country-related specific, we could not notice the similarity of situations among Russian group of interlocutors: dependence on the government support and regional funding, as well as we observed some peculiarities we believe belonging mostly to Indian companies: nepotism and developed technological-based practices. Besides, interviewees from India and USA characterized that entrepreneurial environment in the countries is accounted for business incubation success and rapid development in terms of technologies and practices using.

As a warm-up question and the bridge to "familiarity with a concept" we asked participants to list out associations they have with a collocation "knowledge management". Among most frequent were associations connected with innovations, strategy and collaboration. Noticeable that only a few of interlocutors were open to discussing knowledge management – 7 respondents confessed that they possessed a very small idea of what is that, however, they are *"of course, aware of this collocation".*

Then was asked a question on what technological tools they use for storage, sharing and retrieving information. Extension of the technological tools incorporated varied: Indian company #4 uses local incubation platform that allows to manage most part of inner processes and establish access to external databases and consultants as well, #5 – builds up operations on the basis of SAP platform and solutions, Italian only used Dropbox business solutions and CRM system, Russian companies mentioned Google documents, common chat via WhatsApp, Intranet and basic CRM. The interviewee noticed that *"their incubator does not possess enough resources for aligning and creating an IT strategy and it is not usable for the half of their tenants".*

German incubator, as a part of regional development park, had developed knowledge base, while the rest of participants had Wiki – as it was highlighted by a program coordinator, respondent #8, *"Google sites and most cloud services will get your team and resident confused eventually".*

With regards to the human and organizational based practices, business incubators have several approaches to training and education:

- General track for all the residents
- Personal roadmap
- Both of them

It was noticed by the director of Russian regional incubator, that general track has its benefits for establishing connections between residents, while personal roadmap effective since it implies more personal control and interactions. However, most of the respondents highlighted at different point of conversations the importance of startups' own motivation to grow and/or overcome challenges. Russian representative complained that*:*

"As non-private incubator we have to act in accordance with a law and personality-based selection could not be performed: formally we are forceless and have no right to exclude people with low motivation and who prefer to use a business incubator as a cheap working space with all commodities. Even when deciding on whether we should enroll this entrepreneur in the program, despite the fact that is it noticeable that he do not aimed in the developing of his company, but simply support it and pay low costs, we cannot reject him based on this".

On the network, it was founded that none of the respondents perceive other incubators as potential or actual rivals: on the contrary, they welcome collaboration and exchange of knowledge and expertise. Thus, CEO from Singapore at least once per year visits HSE business incubator in Russia as an invited lecturer. Russian business incubators also participate in HSE's events and meet each other during regional business sessions provided by Chamber of Commerce or Russian Export Center. In the same way, collaboration is established between EU-based incubation centers and in form of FDI in Pakistan. On the internal network, most of participants welcomed an idea of establishing additional connections between incubatees or/and incubatees and organizational parts (overall, only mentors and account/project managers communicate with residents), but in the same time they concluded that incubatees are able to establish a contact by themselves without respect to their own industries.

All the BIs organize counseling sessions by demand and ready to serve an advice also for the companies that are not enrolled. Scheme of working with experts is similar as well: managers of incubator attract project-based consultants and establish permanent work relationships with them if possible. However, as it was noticed by representative of marketing department in Germany, motivation of the external consultants is to sell their own services and eliminate the business incubator as an agent of the transaction, but a business incubator by inviting them,

increases attractiveness of the program and gives an opportunity to learn at least something new for the residents.

Perception of the knowledge management practices and tools, in our interpretation, was rather poor: from the very beginning, people didn't have a clear idea of what is knowledge management is about. When they were asked to describe possible benefits of knowledge management they listed out its influence on innovation capability of the incubator. Only a few participants paid attention to possibilities of capturing knowledge instead of creating. With regards to transferring practices, we noticed that they were mentioned by incubators that has close connections to any university – so the perception of "learning" for them is mostly educational, not expertise sharing.

2.5 Conclusions of the Chapter: main findings

Application survey results to conducted interviews shows that knowledge management systems, both in practices and tools, are undeveloped given an ideal extent of implementation in a business incubator. Interviews light out the reason why KMS had not yet gained a trust of the business society: obscure concept of knowledge management in business field and the lack of observable benefits it could bring. We recognize two options for demonstrating the advantageous of strategic BIs: either practically or speculatively.

Practical dimension is time and effort consuming and is not appropriate without theoretical foundations. An actual implementation would require accurate measurement of the BI's performance before and after ensuring that no other changes were undertaken – so experimental conditions are not possible. Additional case-studies and research to prove the reality of beneficial effect would require the involvement of multiple academics and time-series to ensure the reliability of the model. Giving only the reasoning possibility of restoration of the middle logical element, we continue our goal to develop an integrated knowledge management system aligning it not only with the framework, developed in the first part of our research, but also with empirical findings, which are:

- Poor understanding of knowledge management concept
- Low estimation of benefits from the KMS
- The moderate extent of KMS tools used by business incubators
- Lack of focus on KM processes, namely, transferring, storage and retrieval

- Lack of managerial efforts of aligning knowledge management with organization: practices of knowledge transfer, storage and facilitating.

Chapter 3. Knowledge management system in a business incubator

3.1 Theoretical allignment and contributions

Empirical findings of the current research testify on the low image of knowledge management within the business incubation industry. This state of affairs contradicts the picture of the significant role of knowledge management practices and tools in knowledge-intense organizations that we expected to be after literature research on related topics. However, business incubators, as well as researches, are more concerned with training programs that are only a part of knowledge management system not having in mind the whole concept.

While it was concluded from Moore-Bygrave entrepreneurial model (innovation – triggering event – implementation – growth) that business incubation focus should be on the implementation and growth stages (Bygrave, 2004), business incubators tend more to expect innovation capability enhancement from knowledge management practices. We account this perception on the lack of understanding of the knowledge management concept that we discovered in the set of interviews. Besides, an obscure distinguish of an incubator from an accelerator or venture funds used both in the practical and academic field, influence on this perception.

The research indicates that the most problematic zones for business incubator are IT support and knowledge management processes, which basically means poor alignment of tools with knowledge processes – and the interviews supplement this finding: a shortage of roles within an organization responsible for the development of knowledge management system. Noticeably, however, that the most part or participants both of survey and interviews, knowing where the information they shared is used, asked to share with them the paper because they were interested in the concept and getting findings.

Similar conclusions were drawn when we applied the interviews' results to Wiig model (Mohapatra, Agrawal, & Satpathy, 2016). Build stage is under attention of business incubators as it is implemented through various training and development programs; hold stage is mainly carried our through the mentors' network and expertise they possess and ready to share, with a low exertion of inter-incubatees knowledge flow that is carrying out in unguided way and is rarely facilitated by an incubator; pool stage, in which KMS takes the core role is mostly undeveloped, indicating that business incubators pays little attention to developing the system and transforming tacit knowledge into explicit; a use stage, as it was noticed by our interlocutor in one of the interviews,

is rather depend on the resident firm and the entrepreneur - main control instrument that a business incubator can possess is a selection process with respect to personality of the startup owned.

With respect to knowledge conversion model we observed the lack of socialization and externalization practices, which was unexpected: according to Bandera et al. (2017), startup firms by themselves concentrate mostly on internalization and combination, while they do not possess yet resources for knowledge mapping, portals and groupware development. Our logic that business incubators than provide they residents with this tools was based on the complementary and assisting role that incubators take and it would be beneficial to conduct a set of interviews related to this situation.

The main theoretical contribution of our research is an explored lack of awareness of knowledge management systems. We believe that possibilities of KMS usage for business incubators are bigger than they currently are, but to investigate it the case-study should be provided comparing results and practices of two types of incubators: profound in knowledge with those who barely operate with a concept.

3.2 Managerial implications

The results of this research can be used by business incubators as well as by providers of KMS related applications. With respect to business incubators, the paper analyses the current state of affairs within an industry in terms of KMS use and discoveres that depth and breadth of use depends on:

(1) goals of an organization: to be profitable, to provide social and technocal support, to encourage economic development, to compete successfully;
(2) strategic value of knowledge for a business incubator and its tenants;
(3) resources BI possess.

Taking into consideration tremendous growth that incubation industry been through for last 40 year since it factual appearance, and increase in entrepreneurial rate, the demand on knowledge support systems is expected to get bigger, entaring the phase of intense competition on the quality basis. Thus, the current research explores product opportunities for KMS providers and application of the artifact of long-term development for business incubators.

To be able to define a starting point we propose to use strategic value and resources invested analysis (Centobelli, Cerchione, & Esposito, 2018) based on the same format of interview

with a representative of the company. It is recommended to assess a performance of the company as well. As for now, due to undeveloped level of KMSs in the industry we expect any performance effect to be either low or even absent – other factors, such as selection process, economic environment and conditions, motivation of agents directly participating in a firm support and growth, seemed to have more apparent influence, according to the interviews analysis.

3.3 Model alignment

The set of interviews that were conducted during the study allowed to complement our initial model we designed after the literature review on business incubators and knowledge management, with following adjustments, market in violet color:

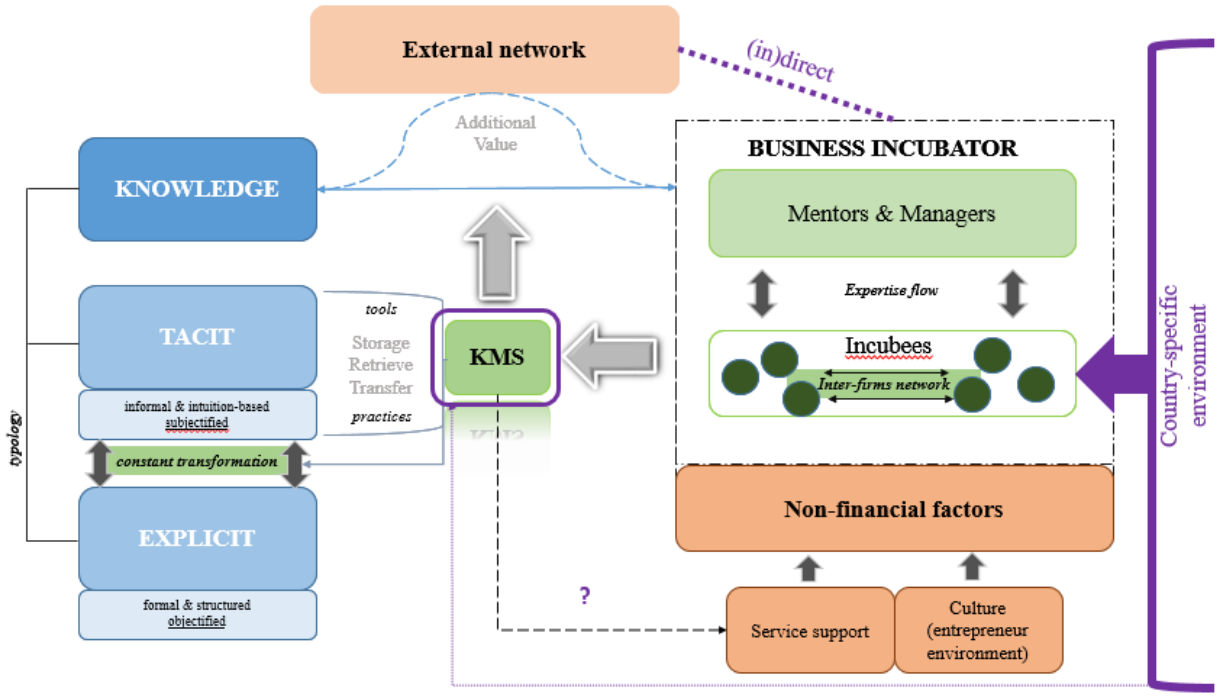

Figure 9. KMS specific alignment

An access to external network was noticed as not to be necessary for a business incubator to function but desirable for it to prosper and enhance knowledge and network capabilities of its incubatees. Moreover, when the access is presented, it is conducted in two possible ways: direct and indirect. Through the direct, an access to the external network is permanent, without respect whether it is IT-based access or regularly organized activities. An indirect access conducted only through symposium or seminar-like activities on the base of the incubator and outside. The distinction is the contract conditions: in case of indirect access, the external experts are either not

or limited paid and motivated by the opportunity to exclude incubator as an intermediate, while with direct access, an incubator always plays this role.

Country-specific environment could influence the peculiarity of business incubators in terms of (1) an extent of government support and control and (2) cultural peculiarities of the region, such as an entrepreneurial spirit, and, as a consequence, the degree of success an incubatee is tend to aim.

As to exploration of non-financial factors that knowledge management practices and systems influence on, most interviewees, notice the influence of practices on the success of the incubatees performance during incubation period and after the graduation. Country-specific environment influences cultural foundation of non-financial performance, while design of KMS might influence the service quality. However, regional specifics also might affect the specific design and possibilities of KMS: practices commonly accepted and implemented, support criteria, etc.

Thus, future research advised to be designed taking into consideration regional and cultural influence on the business incubators. For the current research this finding implies impropriety of generalization except for the purpose of detecting common senses and places.

3.4 Limitations and future research

Limitations of the research are caused by its exploratory nature, bringing meanwhile, elaboration sufficient for the future explanatory proceedings. The purpose the research was to develop an understanding and insights on the knowledge management practices and tools in the business incubation industry.

First limitation is subjectivity of the author. Mostly, the current paper is open to interpreter bias. Despite the fact that we tried to conduct interviews and their further analysis as close to truth hiden, tacit knowledge, we cannot be sure that interpersonal interpretation was fairly reliable to draw conclusions.

Second is the complexity of discipline involved in the study on knowledge management and its organizational practices: assurance of preservation of logical and conceptual chains and bridges could be withheld until the other is not proven, which is likely to happen sooner or later taking

into consideration axiomatic absence within social subjects and dynamic character of the object of the study.

Third, generalization of the study is limited by relatively small sample of survey and interviews. Thus, we propose to start furher movement towards the topic on the explanatory basis and investigate influence of particular parts of KMS on the incubator's performance. To boost an interest towards knowledge management we suggest to address a questions of strategic value and resources invested as the first determinants. For example, non-profit incubator might only afford an informal system, which leads to the option on enhancement informal model and facilitating intercommunication.

As well, generalization was shown to be complicated by differences in perception of business incubation power on the tenants' success: country or even regional peculiarities affect both the perception and requirements for the incubatees and incubators.

Finally, since it was discovered that knowledge management is rather blurred concept for representatives of business incubators, results on the questions included any KM concept (such as facilitating, transferring, etc.) might be biased because of the different recognition of the notions by the author of the research and participants.

By virtue of the current paper, we propose two methodological options for the future research on the topic: exploratory and explanatory. We give a preference to the first option because of the complexity of the subject and its yet low recognition within a business society. Exploratory research is still needed to gather the preliminary information on the peculiarities of knowledge management systems in business incubators: to investigate recognition and practices implemented by profound in knowledge management incubators and those who does not treat it strategically yet, to reveal more insights on its alignment in the ecosystem. However, explanatory study could be designed to gain statistical significance of interconnections of knowledge management practices and tools.

A case study within the same counties taken would allow to generalize and align model for this particular specifics meanwhile investigating both non-financial benefits more: from different perspectives in the same incubator. Detail excretion of factors creates a bridge to statistical modeling if the sample is big enough – for this purposes China and United States most suitable due to a large number of business incubators.

3.5 Conclusion

The purpose of the research was to overcome the scarcity of theoretical contributions and gain an image of the actual state of knowledge management systems, taken as practices and tools, through the lens of a business incubator.

It was discovered that most representatives of business incubators do not fully possess an understanding of knowledge management concept and thus, with respect to system design and implementation, are limited by the tools and practices devoted to resolving of particular problems instead of focus on development. In other words, when it comes to setting up a knowledge management system, business incubators, without relevant knowledge of KM, establish short-term solutions and lack long-term horizon as well as a strategical perception. Undeveloped recognition and familiarity with a concept brings a low range of estimation of benefits from the KMS and a moderate extent of KMS tools used by business incubators.

The insights gained through the survey and set of interviews, we inscribed into already existing models and frameworks of knowledge processes and tools so that our highlights could be used in the future both in theoretical and practical fields to overcome the lack of focus on knowledge, transferring, storage and retrieval and combination and externalization practices.

As a plausible hypothesis we aimed to establish, connecting theoretical investigation and empirical findings, we proposed a concept of conformity of the “pool” stage of Wiig model to the growth phase in the Moore-Bygrave model of entrepreneurial process that takes place within walls of business incubators. Thus, for business incubators, the focus from establishing internalization and combination practices that usually implemented by startups themselves should be switched towards externalization and socialization practices and tools: knowledge maps and portals that underused currently and knowledge-based systems instead of regular document repositories.

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